

WHAT IS CLAIMED IS:

1. A method including:
 - detecting a first fiducial point, associated with a first heart depolarization, at a first electrode associated with a first heart chamber;
 - detecting the first fiducial point, associated with the first heart depolarization, at a second electrode associated with the first heart chamber;
 - determining a timing between the detecting the first fiducial point at the first electrode and the detecting the first fiducial point associated with the second electrode;
 - selecting the first electrode if the first fiducial point is detected at the second electrode before the first fiducial point is detected at the first electrode, and selecting the second electrode if the first fiducial point is detected at the first electrode before the first fiducial point is detected at the second electrode; and
 - delivering from a selected electrode a subsequent stimulation for evoking a contraction of the first heart chamber.
2. The method of claim 1, in which the first heart chamber is a ventricle, selected from a left ventricle and a right ventricle, and the first heart depolarization is a QRS complex associated with one contraction of the ventricle.
3. The method of claim 2, in which the first fiducial point is associated with a peak of an R-wave in the QRS complex.
4. The method of claim 2, further including disposing the first electrode at one of a base, midregion, and apex of a free wall of the ventricle, and disposing the second electrode at a different one of the base, midregion, and apex of the free wall of the ventricle.

5. The method of claim 1, in which selecting includes selecting the first electrode if, over a plurality of cardiac cycles, the first fiducial point is statistically detected at the second electrode before the first fiducial point is statistically detected at the first electrode, and selecting the second electrode if, over the plurality of cardiac cycles, the first fiducial point is statistically detected at the first electrode before the first fiducial point is statistically detected at the second electrode.
6. The method of claim 5, in which selecting further includes selecting one of the first and second electrodes located closer to a heart apex if the first fiducial point is statistically detected at both of the first and second electrodes at substantially the same time.
7. The method of claim 1, further including repeating the steps of claim 1 after a plurality of cardiac cycles.
8. The method of claim 1, in which selecting includes selecting one of the first and second electrodes that is closer to a heart apex if the first fiducial point is detected at both of the first and second electrodes at substantially the same time.
9. The method of claim 1, in which selecting includes selecting the first electrode if the first fiducial point is detected at the second electrode before, by at least a threshold time, the first fiducial point is detected at the first electrode, and selecting the second electrode if the first fiducial point is detected at the first electrode before, by at least the threshold time, the first fiducial point is detected at the second electrode.
10. The method of claim 1, in which determining the timing includes:
detecting at least one reference fiducial point;

measuring first and second time intervals between the at least one reference fiducial point and the first fiducial point detected at the respective first and second electrodes; and

comparing the first and second time intervals.

11. A method including:

detecting, from a first electrode associated with a first heart chamber, a first fiducial point associated with a first depolarization of the first heart chamber;

detecting, from a second electrode associated with a second heart chamber, a second fiducial point associated with a second depolarization of the second heart chamber;

detecting, from a third electrode associated with the second heart chamber, a third fiducial point associated with the second depolarization of the second heart chamber, in which the second and third fiducial points are substantially similarly located on the second depolarization;

measuring a first time difference between the first and second fiducial points;

measuring a second time difference between the first and third fiducial points;

selecting the second electrode if the first time difference is longer than the second time difference, and selecting the third electrode if the second time difference is longer than the first time difference; and

delivering from a selected electrode a subsequent stimulation for evoking a contraction of the second heart chamber.

12. The method of claim 11, in which the second heart chamber is a ventricle, selected from a left ventricle and a right ventricle, and the second heart depolarization is a QRS complex associated with one contraction of the ventricle.

13. The method of claim 12, in which the second and third fiducial points are associated with a peak of an R-wave in the QRS complex.

14. The method of claim 11, in which the first heart chamber is a different ventricle from that of the second heart chamber, the first heart depolarization is a QRS complex associated with the first heart chamber, and the first fiducial point is associated with the first heart depolarization.

15. The method of claim 11, in which the first heart chamber is an atrium, selected from a right atrium and a left atrium, the first heart depolarization is a P-wave associated with a contraction of the atrium, and the first fiducial point is associated with the first heart depolarization.

16. The method of claim 11, further including disposing the second electrode at one of a base, midregion, and apex of one of a free wall and an anterior wall of a ventricle, and disposing the third electrode at a different one of the base, midregion, and apex of the one of the free wall and the anterior wall of the same ventricle.

17. The method of claim 11, in which selecting includes selecting the second electrode if, over a plurality of cardiac cycles, the first time difference is statistically longer than the second time difference, and selecting the third electrode if, over the plurality of cardiac cycles, the second time difference is statistically longer than the first time difference.

18. The method of claim 17, in which selecting further includes selecting one of the second and third electrodes located closer to a heart apex if the first and second time differences are statistically substantially equal.

19. The method of claim 11, further including repeating the steps of claim 11 after a plurality of cardiac cycles.
20. The method of claim 11, in which selecting further includes selecting one of the second and third electrodes located closer to a heart apex if the first and second time differences are substantially equal.
21. The method of claim 11, in which selecting further includes selecting the second electrode if the first time difference is longer than the second time difference by a threshold time, and selecting the third electrode if the second time difference is longer than the first time difference by the threshold time.
22. A method including:
- detecting, from a first electrode associated with a first heart chamber, a first fiducial point associated with a first depolarization of the first heart chamber during a first cardiac cycle;
 - detecting, from a second electrode associated with a second heart chamber, a second fiducial point associated with a second depolarization of the second heart chamber during the first cardiac cycle;
 - detecting, from the first electrode associated with the first heart chamber, a third fiducial point associated with a third depolarization of the first heart chamber during a second cardiac cycle, and in which the first and third fiducial points are substantially similarly located on the respective first and third depolarizations;
 - detecting, from a third electrode associated with the second heart chamber, a fourth fiducial point associated with a fourth depolarization of the second heart chamber during the second cardiac cycle, in which the second and fourth fiducial points are substantially similarly located on the respective second and fourth depolarizations

measuring a first time difference between the first and second fiducial points;
measuring a second time difference between the third and fourth fiducial points;

selecting the second electrode if the first time difference is longer than the second time difference, and selecting the third electrode if the second time difference is longer than the first time difference; and

delivering from a selected electrode a subsequent stimulation for evoking a contraction of the second heart chamber.

23. The method of claim **22**, in which the second heart chamber is a ventricle, selected from a left ventricle and a right ventricle, and the second and fourth depolarizations are QRS complexes associated with different contractions of the ventricle.

24. The method of claim **23**, in which the second and fourth fiducial points are each associated with a peak of an R-wave in the respective QRS complexes.

25. The method of claim **23**, in which the first heart chamber is a different ventricle from that of the second heart chamber, and the first and third depolarizations are different QRS complexes associated with the first heart chamber, and the first and third fiducial points are associated with the respective first and third depolarizations.

26. The method of claim **22**, in which the first heart chamber is an atrium, selected from a right atrium and a left atrium, and the first and third depolarizations are P-waves associated with different contractions of the atrium, and the first and third fiducial points are associated with the respective first and third depolarizations.

27. The method of claim **22**, further including disposing the second electrode at one of a base, midregion, and apex of one of a anterior wall and a free wall of a ventricle, and disposing the third electrode at a different one of the base, midregion, and apex of the one of the anterior wall and the free wall of the same ventricle.

28. The method of claim **22**, in which selecting includes selecting the second electrode if, over a plurality of cardiac cycles, the first time difference is statistically longer than the second time difference, and selecting the third electrode if, over the plurality of cardiac cycles, the second time difference is statistically longer than the first time difference.

29. The method of claim **28**, in which selecting further includes selecting the one of the second and third electrodes that is located closer to a heart apex if the first and second time differences are statistically substantially equal.

30. The method of claim **22**, further including repeating the steps of claim **22** after a plurality of cardiac cycles.

31. The method of claim **22**, in which selecting further includes selecting one of the second and third electrodes located closer to a heart apex if the first and second time differences are substantially equal.

32. The method of claim **22**, in which selecting further includes selecting the second electrode if the first time difference is longer than the second time difference by a threshold time, and selecting the third electrode if the second time difference is longer than the first time difference by the threshold time.

33. A system including:

first and second electrodes, both configured to be associated with a first heart chamber;

a sensing circuit, coupled to the first and second electrodes, the sensing circuit detecting heart depolarizations associated with the first heart chamber, including detecting a first depolarization time at which a first depolarization of the first heart chamber is received at the first electrode, and detecting a second depolarization time at which the first depolarization of the first heart chamber is received at the second electrode;

a therapy circuit delivering stimulations for evoking heart contractions from at least one of the first and second electrodes; and

a controller, coupled to the sensing circuit, the controller selecting the second electrode if the first depolarization time occurs before the second depolarization time, and selecting the first electrode if the second depolarization time occurs before the first depolarization time, the controller coupling the therapy circuit to the selected one of the first and second electrodes for delivering the stimulations.

34. The system of claim **33**, in which the first and second electrodes are configured to be associated with a ventricle selected from a group consisting of a left ventricle and a right ventricle.

35. The system of claim **33**, in which the sensing circuit provides, over a plurality of cardiac cycles, a plurality of first depolarization times and a plurality of second depolarization times, and the controller computes a first statistic associated with the plurality of first depolarization times and a second statistic associated with the plurality of second depolarization times, and the controller selects one of the first and second electrodes based on a comparison between the first and second statistics, and the controller couples the therapy circuit to the selected one of the first and

second electrodes for delivering the stimulations.

36. The system of claim **35**, in which the controller selects the first electrode if the second depolarization times statistically occur before the first depolarization times and selects the second electrode if the first depolarization times statistically occur before the second depolarization times.

37. The system of claim **36**, in which the controller selects one of the first and second electrodes that is located closer to a heart apex if the first and second depolarization times statistically occur at approximately the same time.

38. The system of claim **33**, in which the controller selects the first electrode if the second depolarization occurs before the first depolarization by a predetermined threshold time, selects the second electrode if the first depolarization occurs before the second depolarization by the predetermined threshold time, and otherwise selects one of the first and second electrodes located closer to a heart apex.

39. The system of claim **33**, in which after the therapy circuit delivers stimulations from the selected one of the second and third electrodes over a plurality of cardiac cycles, the timer again computes first and second time intervals, the controller again selects one of the first and second electrodes for then coupling the therapy circuit to the selected one of the first and second electrodes for delivering the stimulations.

40. The system of claim **33**, further including a remote programmer communicatively coupled to the controller, the programmer capable of receiving from the controller an indication of which of the first and second electrodes is selected for delivering the stimulations.

41. A system including:

- a first electrode configured to be associated with a first heart chamber;
- second and third electrodes, both configured to be associated with a second heart chamber;
- a sensing circuit, coupled to the first, second, and third electrodes, the sensing circuit detecting heart depolarizations from the first and second chambers;
- a timer, coupled to the sensing circuit, the timer measuring a first time interval between a first depolarization received at the first electrode and a subsequent second depolarization received at the second electrode during the same cardiac cycle, and measuring a second time interval between the first depolarization received at the first electrode and the subsequent second depolarization received at the third electrode during the same cardiac cycle;
- a therapy circuit delivering stimulations for evoking heart contractions from one of the second and third electrodes; and
- a controller, coupled to the timer, the controller selecting the second electrode if the first time interval is longer than the second time interval, and selecting the third electrode if the second time interval is longer than the first time interval, the controller coupling the therapy circuit to the selected one of the second and third electrodes for delivering the stimulations.

42. The system of claim **41**, in which the second and third electrodes are configured to be associated with a ventricle selected from a group consisting of a left ventricle and a right ventricle.

43. The system of claim **42**, in which the first electrode is configured to be associated with the first heart chamber, which is selected from the group consisting of a ventricle different from the ventricle associated with the second and third electrodes, a right atrium, and a left atrium.

44. The system of claim **41**, in which the timer provides, over a plurality of cardiac cycles, a plurality of first and second time intervals, and the controller computes a first statistic associated with the plurality of first time intervals and a second statistic associated with the plurality of second time intervals, and the controller selects one of the second and third electrodes based on a comparison between the first and second statistics, and the controller couples the therapy circuit to the selected one of the second and third electrodes for delivering the stimulations.

45. The system of claim **44**, in which the controller selects the second electrode if the first time interval is statistically longer than the second time interval, and selects the third electrode if the second time interval is statistically longer than the first time interval.

46. The system of claim **45**, in which the controller selects one of the first and second electrodes that is located closer to a heart apex if the first and second time intervals are statistically substantially equal.

47. The system of claim **41**, in which the controller selects the second electrode if the first time interval is longer than the second time interval by a time threshold, and selects the third electrode if the second time interval is longer than the first time interval by the threshold, and otherwise selects one of the first and second electrodes located closer to a heart apex.

48. The system of claim **41**, in which after the therapy circuit delivers stimulations from the selected one of the second and third electrodes over a plurality of cardiac cycles, the timer again computes first and second time intervals, the controller again selects one of the second and third electrodes for then coupling the therapy circuit to the selected one of the second and third electrodes for delivering

the stimulations.

49. The system of claim **41**, further including a remote programmer communicatively coupled to the controller, the programmer capable of receiving from the controller an indication of which of the second and third electrodes is selected for delivering the stimulations.

50. A system including:

- a first electrode configured to be associated with a first heart chamber;
- second and third electrodes, both configured to be associated with a second heart chamber;

- a sensing circuit, coupled to the first, second, and third electrodes, the sensing circuit detecting heart depolarizations from the first and second chambers;

- a timer, coupled to the sensing circuit, the timer measuring a first time interval between a first depolarization received at the first electrode during a first cardiac cycle and a subsequent second depolarization received at the second electrode during the first cardiac cycle, and measuring a second time interval between a third depolarization received at the first electrode during a second cardiac cycle and a subsequent fourth depolarization received at the third electrode during the second cardiac cycle;

- a therapy circuit delivering stimulations for evoking heart contractions from one of the second and third electrodes; and

- a controller, coupled to the timer, the controller selecting the second electrode if the first time interval is longer than the second time interval, and selecting the third electrode if the second time interval is longer than the first time interval, the controller coupling the therapy circuit to the selected one of the second and third electrodes for delivering the stimulations.

51. The system of claim **50**, in which the second and third electrodes are configured to be associated with a ventricle selected from a group consisting of a left ventricle and a right ventricle.

52. The system of claim **51**, in which the first electrode is configured to be associated with the first heart chamber, which is selected from the group consisting of a ventricle different from the ventricle associated with the second and third electrodes, a right atrium, and a left atrium.

53. The system of claim **50**, in which the timer provides, over a plurality of cardiac cycles, a plurality of first and second time intervals, and the controller computes a first statistic associated with the plurality of first time intervals and a second statistic associated with the plurality of second time intervals, and the controller selects one of the second and third electrodes based on a comparison between the first and second statistics, and the controller couples the therapy circuit to the selected one of the second and third electrodes for delivering the stimulations.

54. The system of claim **53**, in which the controller selects the second electrode if the first time interval is statistically longer than the second time interval, and selects the third electrode if the second time interval is statistically longer than the first time interval.

55. The system of claim **54**, in which the controller selects one of the first and second electrodes that is located closer to a heart apex if the first and second time intervals are statistically substantially equal.

56. The system of claim **53**, in which after the therapy circuit delivers stimulations from the selected one of the second and third electrodes over a plurality

of cardiac cycles, the timer again computes first and second time intervals, the controller again selects one of the second and third electrodes for then coupling the therapy circuit to the selected one of the second and third electrodes for delivering the stimulations.

57. The system of claim **50**, further including a remote programmer communicatively coupled to the controller, the programmer capable of receiving from the controller an indication of which of the second and third electrodes is selected for delivering the stimulations.

58. The system of claim **50**, in which the controller selects the second electrode if the first time interval is longer than the second time interval by a time threshold, and selects the third electrode if the second time interval is longer than the first time interval by the threshold, and otherwise selects one of the first and second electrodes located closer to a heart apex.

59. A method including:

- detecting, from one of first and second electrodes, each associated with a first heart chamber, a first fiducial point associated with a first depolarization of the first heart chamber;

- detecting, from the first electrode, a second fiducial point associated with the first depolarization;

- detecting, from one of the first and second electrodes, a third fiducial point associated with a second depolarization of the first heart chamber;

- detecting, from the second electrode, a fourth fiducial point associated with the second depolarization;

- measuring a first time interval between the first and second fiducial points;

- measuring a second time interval between the third and fourth fiducial

points;

selecting the first electrode if the first time interval is longer than the second time interval, and selecting the second electrode if the second time interval is longer than the first time interval; and

delivering from the selected electrode a subsequent stimulation for evoking a contraction of the first heart chamber.

60. The method of claim **59**, in which the first heart chamber is a ventricle selected from a right ventricle and a left ventricle, and the first and second depolarizations are QRS complexes associated with the first heart chamber.

61. The method of claim **59**, in which the first fiducial point is associated with an onset of the first depolarization, the second fiducial point is associated with an R-wave peak of the first depolarization, the third fiducial point is associated with an onset of the second depolarization, and the fourth fiducial point is associated with an R-wave peak of the second depolarization.

62. The method of claim **59**, further including selecting one of the first and second electrodes that is closer to a heart apex if the first and second time intervals are substantially equal.

63. The method of claim **59**, in which selecting includes selecting the first electrode if the first time interval is longer than the second time interval by a threshold time, selecting the second electrode if the second time interval is longer than the first time interval by the threshold time, and otherwise selecting one of the first and second electrodes that is located closer to a heart apex.

64. A system including:

first and second electrodes configured to be associated with a first heart chamber;

a sensing circuit, coupled to the first and second electrodes, the sensing circuit detecting from one of the first and second electrodes a first fiducial point associated with a first heart depolarization of the first heart chamber, the sensing circuit detecting from the first electrode a second fiducial point associated with the first heart depolarization, the sensing circuit detecting from one of the first and second electrodes a third fiducial point associated with a second heart depolarization of the first heart chamber, the sensing circuit detecting from the second electrode a fourth fiducial point associated with the second heart depolarization;

a timer, coupled to the sensing circuit, the timer measuring a first time interval between the first and second fiducial points, and measuring a second time interval between the third and fourth fiducial points;

a therapy circuit delivering stimulations for evoking heart contractions from one of the first and second electrodes; and

a controller, coupled to the timer, the controller selecting the first electrode if the first time interval exceeds the second time interval, the controller selecting the second electrode if the second time interval exceeds the first time interval, the controller coupling the therapy circuit to the selected one of the first and second electrodes for delivering the stimulations.

65. The system of claim **64**, in which the controller selects one of the first and second electrodes that is located closer to a heart apex if the first and second time intervals are substantially equal.

66. The system of claim **64**, in which the first and second electrodes are configured to be associated with a ventricle selected from a group consisting of a left ventricle and a right ventricle.

67. The system of claim **64**, in which the timer provides, over a plurality of cardiac cycles, a plurality of first and second time intervals, and the controller computes a first statistic associated with the plurality of first time intervals and a second statistic associated with the plurality of second time intervals, and the controller selects one of the first and second electrodes based on a comparison between the first and second statistics, and the controller couples the therapy circuit to the selected one of the first and second electrodes for delivering the stimulations.

68. The system of claim **67**, in which the controller selects the first electrode if the first time interval is statistically longer than the second time interval, and selects the second electrode if the second time interval is statistically longer than the first time interval.

69. The system of claim **67**, in which the controller selects one of the first and second electrodes that is located closer to a heart apex if the first and second time intervals are statistically substantially equal.

70. The system of claim **64**, in which after the therapy circuit delivers stimulations from the selected one of the first and second electrodes over a plurality of cardiac cycles, the timer again computes first and second time intervals, the controller again selects one of the first and second electrodes for then coupling the therapy circuit to the selected one of the first and second electrodes for delivering the stimulations.

71. The system of claim **64**, further including a remote programmer communicatively coupled to the controller, the programmer capable of receiving from the controller an indication of which of the first and second electrodes is selected for delivering the stimulations.

72. The system of claim **64**, in which the controller selects the first electrode if the first time interval is longer than the second time interval by a time threshold, and selects the second electrode if the second time interval is longer than the first time interval by the threshold, and otherwise selects one of the first and second electrodes located closer to a heart apex.

73. A method including:

- detecting, from one of first and second electrodes, each associated with a first heart chamber, a first fiducial point associated with a first depolarization of the first heart chamber;

- detecting, from the first electrode, a second fiducial point associated with the first depolarization;

- detecting, from the second electrode, a third fiducial point associated with the first depolarization;

- measuring a first time interval between the first and second fiducial points;

- measuring a second time interval between the first and third fiducial points;

- selecting the first electrode if the first time interval is longer than the second time interval, and selecting the second electrode if the second time interval is longer than the first time interval; and

- delivering from the selected electrode a subsequent stimulation for evoking a contraction of the first heart chamber.

74. The method of claim **73**, in which the first heart chamber is a ventricle selected from a right ventricle and a left ventricle, and the first and second depolarizations are QRS complexes associated with the first heart chamber.

75. The method of claim **73**, in which the first fiducial point is associated with an onset of the first depolarization, the second and third fiducial points are

associated with an R-wave peak of the first depolarization.

76. The method of claim 73, further including selecting one of the first and second electrodes that is closer to a heart apex if the first and second time intervals are substantially equal.

77. The method of claim 73, in which selecting includes selecting the first electrode if the first time interval is longer than the second time interval by a threshold time, selecting the second electrode if the second time interval is longer than the first time interval by the threshold time, and otherwise selecting one of the first and second electrodes that is located closer to a heart apex.

78. A system including:

first and second electrodes configured to be associated with a first heart chamber;

a sensing circuit, coupled to the first and second electrodes, the sensing circuit detecting from one of the first and second electrodes a first fiducial point associated with a first heart depolarization of the first heart chamber, the sensing circuit detecting from the first electrode a second fiducial point associated with the first heart depolarization, the sensing circuit detecting from the second electrode a third fiducial point associated with the first heart depolarization;

a timer, coupled to the sensing circuit, the timer measuring a first time interval between the first and second fiducial points, and measuring a second time interval between the first and third fiducial points;

a therapy circuit delivering stimulations for evoking heart contractions from one of the first and second electrodes; and

a controller, coupled to the timer, the controller selecting the first electrode if the first time interval exceeds the second time interval, the controller selecting the

second electrode if the second time interval exceeds the first time interval, the controller coupling the therapy circuit to the selected one of the first and second electrodes for delivering the stimulations.

79. The system of claim **78**, in which the controller selects one of the first and second electrodes that is located closer to a heart apex if the first and second time intervals are substantially equal.

80. The system of claim **78**, in which the first and second electrodes are configured to be associated with a ventricle selected from a group consisting of a left ventricle and a right ventricle.

81. The system of claim **78**, in which the timer provides, over a plurality of cardiac cycles, a plurality of first and second time intervals, and the controller computes a first statistic associated with the plurality of first time intervals and a second statistic associated with the plurality of second time intervals, and the controller selects one of the first and second electrodes based on a comparison between the first and second statistics, and the controller couples the therapy circuit to the selected one of the first and second electrodes for delivering the stimulations.

82. The system of claim **81**, in which the controller selects the first electrode if the first time interval is statistically longer than the second time interval, and selects the second electrode if the second time interval is statistically longer than the first time interval.

83. The system of claim **81**, in which the controller selects one of the first and second electrodes that is located closer to a heart apex if the first and second time intervals are statistically substantially equal.

84. The system of claim **78**, in which after the therapy circuit delivers stimulations from the selected one of the first and second electrodes over a plurality of cardiac cycles, the timer again computes first and second time intervals, the controller again selects one of the first and second electrodes for then coupling the therapy circuit to the selected one of the first and second electrodes for delivering the stimulations.

85. The system of claim **78**, further including a remote programmer communicatively coupled to the controller, the programmer capable of receiving from the controller an indication of which of the first and second electrodes is selected for delivering the stimulations.

86. The system of claim **78**, in which the controller selects the first electrode if the first time interval is longer than the second time interval by a time threshold, and selects the second electrode if the second time interval is longer than the first time interval by the threshold, and otherwise selects one of the first and second electrodes located closer to a heart apex.